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THE EFFECT OF FEEDING NATURAL WATER FLEA (*Daphnia* sp.) WITH DIFFERENT DOSAGE ON THE ABSOLUTE GROWTH WEIGHT OF SEEDS GUPPY FISH (*Poecilia reticulata*) WITHIN 5 – 45 DAYS IN THE EXPERIMENT TUBS

Pengaruh Pemberian Pakan Alami Kutu Air *(Daphnia* sp.) dengan Dosis yang Berbeda Terhadap Pertumbuhan Berat Mutlak Benih Ikan Gapi (*Poecilia reticulata*) Mulai Umur 5-45 Hari Di Bak-Bak Percobaan

Muhajir and Totok Hariyanto*

Faculty of Food and Fisheries Technology, Dr. Soetomo University

Semolowaru Street No. 84, Menur Pumpungan, Sukolilo District, Surabaya, East Java, Indonesia

*Corresponding Author: totok.hariyanto6@gmail.com

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ABSTRACT

The development of ornamental fish in Indonesia is increasing, especially for freshwater ornamental fish. One of the freshwater ornamental fish that is in great demand by the people today is the guppy fish (*Poecilia reticulata*). Water fleas (*Daphnia* sp) is one type of natural food consumed by freshwater fish species. Feeding fish seed is an important factor that must be considered. The purpose of this study was to determine the optimal dose of natural feed *(Daphnia* sp) for the absolute growth weight of seeds guppy fish (*Poecilia reticulata*) within 5 — 45 days. This study used an experimental method with complete random design consist of 5 experiments and 5 repetitions. Treatment A uses a dose of 4%, B; 6%, C ; 8%, D ; 10% and E ; 12%. The test animals were guppy fish seeds from 5-45 days old with an average weight of 0,2 g/tail. The stocking density of guppy is 3 fish/lt and the experimental media used fresh water with a volume of 3 lt/tub. The results showed that experiment C giving the highest average on the growth of guppy weight on the aged of 5-45 days with a height of 0,94 g/tail. The water quality data during the study obtained water temperatures range from 27.2°C – 27.9°C, acidity levels range from 7,3 - 7,8 and dissolved oxygen range from 5,2 - 5,7 ppm.

Keywords: Seeds guppy fish (*Poecilia reticulata*) from the age 5-45 days, feeding natural food water flea (*Daphnia* sp.) with different dosage, the absolute growth weight.

ABSTRAK

Perkembangan ikan hias di Indonesia semakin meningkat, khususnya ikan hias air tawar. Salah satu ikan hias air tawar yang saat ini banyak diminati masyarakat adalah ikan guppy (*Poecilia reticulata*). Kutu air (*Daphnia* sp) merupakan salah satu jenis pakan alami yang dikonsumsi oleh ikan air tawar. Pemberian pakan pada benih ikan merupakan faktor penting yang harus diperhatikan. Tujuan penelitian ini adalah untuk menentukan dosis optimal pakan alami *Daphnia sp* terhadap pertumbuhan bobot mutlak benih ikan guppy (*Poecilia reticulata*) umur

5–45 hari. Penelitian ini menggunakan metode eksperimen dengan Rancangan Acak Lengkap (RAL) yang terdiri dari 5 perlakuan dan 5 ulangan. Perlakuan A menggunakan dosis 4%, B 6%, C 8%, D 10%, dan E 12%. Hewan uji yang digunakan adalah benih ikan guppy berumur 5–45 hari dengan berat rata-rata 0,2 g/ekor. Kepadatan tebar sebesar 3 ekor/liter dan media pemeliharaan menggunakan air tawar dengan volume 3 liter/wadah. Hasil penelitian menunjukkan bahwa perlakuan C memberikan hasil tertinggi terhadap pertumbuhan bobot benih ikan guppy umur 5–45 hari, yaitu sebesar 0,94 g/ekor. Data kualitas air selama penelitian menunjukkan suhu berkisar antara 27,2°C – 27,9°C, pH 7,3 – 7,8, dan oksigen terlarut 5,2 – 5,7 ppm.

Kata kunci: Benih ikan guppy (*Poecilia reticulata*) umur 5–45 hari, pakan alami kutu air (*Daphnia* sp) dengan dosis pakan berbeda, pertumbuhan bobot mutlak

INTRODUCTION

The development of freshwater ornamental fish farming in Indonesia has shown significant growth and presents a promising business opportunity. This is supported by ease of maintenance, relatively small land requirements, and a large market segment. One highly sought-after commodity is the guppy (Poecilia reticulata), which has high economic value in both domestic and international markets due to its beautiful colors and varied fin shapes, as well as its strong adaptability (Fish Quarantine Agency, 2018; Sukma, 2007).

The success of guppy fish farming is largely determined by feed management, particularly during the fry stage. The feed provided must be nutritionally complete and easily digestible to support optimal growth. One potential natural feed is water fleas (Daphnia sp.), which are high in protein, sized to accommodate the fry's mouth opening, and contain digestive enzymes that can aid the fish's metabolic processes (Mokoginta, 2003; Schumann, 2007; Lithner et al., 2009).

Providing the correct feed dosage is a crucial factor in supporting the growth of fry. Underfeeding can lead to growth disorders and malnutrition, while overfeeding can degrade water quality and negatively impact fish health. Therefore, determining the optimal feed dosage is necessary to ensure optimal growth of guppies (Sutrisno, 2008; Susanto, 2002).

Based on this, this study aims to analyze the effect of providing different doses of Daphnia sp. natural feed on the absolute weight growth of guppies aged 5–45 days, and to determine the optimal dosage that produces the best growth results. The results of this study are expected to serve as a reference for farmers in increasing the efficiency and productivity of guppies (Murtidjo, 2001).

Specifically, the objectives of this study were to determine the effect of different doses of Daphnia sp. natural feed on the absolute weight growth of guppies (Poecilia reticulata) aged 5–45 days, and to determine the optimal feed dosage to achieve optimal growth in guppies under controlled conditions (Shahjahan et al., 2013; Mokoginta, 2003).

RESEARCH METHODS

Place and Time

The research location was carried out in Kupang Village, Jetis District, Mojokerto Regency, while the research period was 40 days starting from April 21, 2021 to June 1, 2021.

Tools and Materials

The equipment used in this study included 25 plastic tubs with a capacity of 5 liters as research containers, a tank for collecting guppies, siphon hoses, digital scales, plastic bags, measuring cups, an aerator and its accessories, sponges, stationery, a small net, tissue, a plastic spoon, a feed pipette, a thermometer for measuring temperature, scissors, and a mineral water container (a small Aqua) used to support maintenance and observation activities during the study.

The materials used in this study included guppies (Poecilia reticulata) aged 5–45 days with an average weight of 0.2 g per fish, natural food Daphnia sp. with an average weight of 0.0006 g per fish, detergent for cleaning equipment, rubber bands for binding, and fresh water as a maintenance medium during the study.

Containers and Test Animals

The containers used in this study were 25 5-liter plastic tubs, each filled with 3 liters of fresh water from groundwater or wells and allowed to settle for 24 hours before use. The test animals used were 5–45-day-old guppy (Poecilia reticulata) fry with an average weight of 0.2 g/tail and a length of ±1.5 cm/tail, characterized by complete body organs, disease-free, smooth body surfaces, relatively uniform color and size, and agile movements. The fry were obtained from guppy fish farming MSMEs in Mojokerto Regency, East Java Province, and were attempted to come from one pair of parents in one spawning session. The stocking density used was 3 fry/liter, so with a water volume of 3 liters per container and a total of 25 containers, a total of 225 fry were used in this study.

Feed and Feeding

Feed is a major factor in supporting the growth and survival of guppy (Poecilia reticulata) fry, so it must be nutritionally complete, easily digestible, and provided appropriately (Prasetya, 2015; Mudjiman, 2001). One suitable natural feed is Daphnia sp., which has a high nutritional content, a size suitable for the fry's mouth opening, and is easy to cultivate (Wijayanti, 2010; Tarwiyah, 2001). Daphnia sp. is a freshwater zooplankton that has high adaptability and reproduces parthenogenically (Pennak, 1989; Mokoginta, 2003). Feeding needs to pay attention to the dosage and frequency, where the optimal dosage ranges from 5–10% of the biomass weight per day and is given approximately three times a day to support optimal growth of the fry (Sutrisno, 2008; Hanief et al., 2014; Agus et al., 2010).

Research Design

This study uses an experimental method that has a high level of validity because it is carried out with strict control of external variables (Jaedun, 2011). The design used is a Completely Randomized Design (CRD) with 5 treatments and 5 replications, which are determined based on the formula $(t-1)(n-1) \geq 15$ (Kusriningrum, 2010), so that the minimum number of replications is 5. The treatment given is in the form of providing natural feed Daphnia sp with different doses, namely 4%, 6%, 8%, 10%, and 12% of the biomass weight of the test animals, which are respectively equivalent to 120, 180, 240, 300, and 360 Daphnia sp.

Research Procedure

The research procedure included preparation and implementation stages. In the preparation stage, all equipment, such as the holding tanks and 25 experimental tanks, was cleaned using detergent, rinsed, and dried, then arranged according to the research layout. Each tank was filled with 3 liters of fresh water and an aerator was installed. The test animals, consisting of guppies, were weighed to determine their initial weight and then temporarily maintained in the holding tanks. The natural feed Daphnia sp. was weighed and grouped according to the treatment dosage. In the implementation stage, 9 fish were stocked per tank, then fed Daphnia sp. according to the treatment dosage of 4%, 6%, 8%, 10%, and 12% of the biomass, which was given three times a day (morning, noon, and evening). Maintenance was carried out by siphoning the water once a week before the first feeding, and adding water to maintain a constant volume. Water quality (temperature, pH, and dissolved oxygen) was measured three times a day before feeding. At the end of the study, all test animals were weighed again to determine average weight growth as a research outcome parameter.

Data Analysis

The research procedure included preparation and implementation stages. In the preparation stage, all equipment, such as the holding tanks and 25 experimental tanks, was cleaned using detergent, rinsed, and dried, then arranged according to the research layout. Each tank was filled with 3 liters of fresh water and an aerator was installed. The test animals, consisting of guppies, were weighed to determine their initial weight and then temporarily maintained in the holding tanks. The natural feed Daphnia sp. was weighed and grouped according to the treatment dosage. In the implementation stage, 9 fish were stocked per tank, then fed Daphnia sp. according to the treatment dosage of 4%, 6%, 8%, 10%, and 12% of the biomass, which was given three times a day (morning, noon, and evening). Maintenance was carried out by siphoning the water once a week before the first feeding, and adding water to maintain a constant volume. Water quality (temperature, pH, and dissolved oxygen) was measured three times a day before feeding. At the end of the study, all test animals were weighed again to determine average weight growth as a research outcome parameter.

Absolute Weight Growth Observation

Absolute weight growth is defined as the difference between the total body weight of the fish at the end of the study and the total body weight of the fish at the beginning of the study with the following formula (Effendi, 2003) :

$$\boxed{Wm = Wt - Wo}$$

Description:

Wm = Absolute weight of test animals (g)
Wt = Average weight of test animals at the end of the study (g).
Wo = Average weight of test animals at the start of the study (g).

RESULT

Based on the research results, feeding water fleas (Daphnia sp.) at different doses showed differences in the average absolute weight growth of guppy (Poecilia reticulata) fry aged 5–45 days in each treatment. Data included initial weight, final weight, and absolute weight growth, which were then presented as ranges, means, and standard deviations for each treatment. The ranges, means, and standard deviations for the effects of feeding water fleas (Daphnia sp.) at different doses on the absolute weight growth of guppy (Poecilia reticulata) fry aged 5–45 days in the experimental tanks for each treatment are presented in Table 1 below.

Table 1. Ranges, means, and standard deviations for the effects of feeding water fleas (Daphnia sp.) at different doses on the absolute weight growth of guppy (Poecilia reticulata) fry aged 5–45 days in the experimental tanks for each treatment.

Treatment	Absolute Weight Range of Gapi Fish Seed (Poecilia Reticulata) Starting from 5-45 Days of Age	Average (g)	Standard Deviation (sd)
A	0,14 – 0,24	0,19	0,04970
B	0,28 – 0,36	0,31	0,05225
C	1,0 – 1,3	0,94	0,11402
D	0,65 – 0,75	0,71	0,03912
E	0,47 – 0,59	0,53	0,05020

Based on Table1 abo ve, it can be explained that treatment C showed the highest average growth rate in absolute weight of guppy fry from 5-45 days of age. Meanwhile, in treatments D, E, B, and A, the average growth rate of absolute weight of guppy fry from 5-45 days of age decreased sequentially. Figure 1 below presents a graph of the average growth rate of absolute weight of guppy fry aged 5-45 days for each treatment.

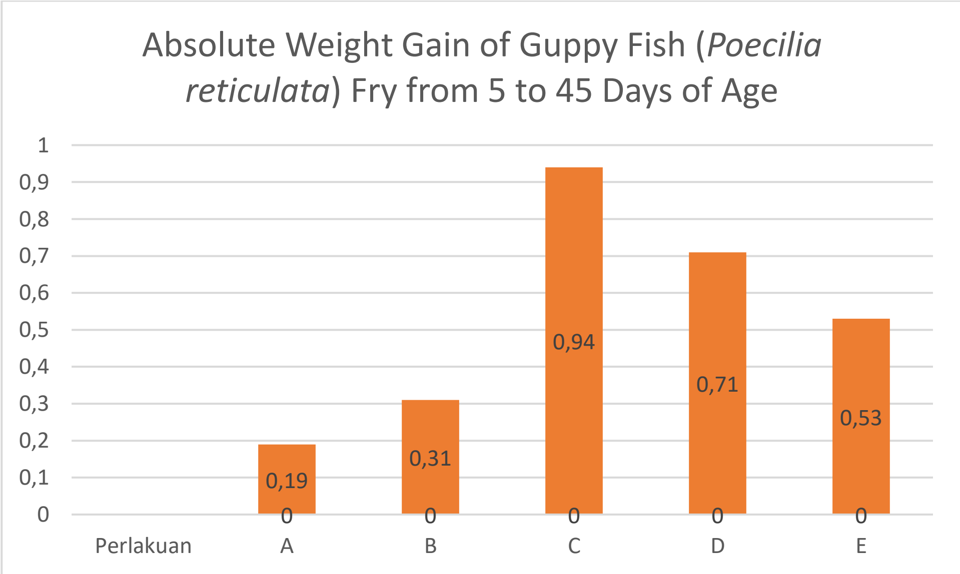

Figure 1 Graph of the average absolute weight level of guppy fish seeds from 5-45 days of age.

In order to determine whether there are significant differences between treatments, a one-way ANOVA test was carried out and the results can be seen in Table 2 below.

Table 2. One-way ANOVA test of the absolute weight level of guppy fry from 5-45 days old.

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1,845	4	0,461	103,629	0,000
Within Groups	0,089	20	0,004		
Total	1,934	24			

Based on Table 2 above, it can be explained that the treatment of providing natural water fleas (Daphnia sp.) with different doses on the absolute weight growth of guppy fry from 5-45 days old (F > Sign.). Furthermore, to determine the level of difference between each treatment on the absolute weight growth of guppy fry aged 4-45 days, a 5% BNJ test was conducted, as seen in Table 3 below.

Table 3. Average and Notation of Absolute Weight Growth Rate of Guppy Fry Aged 4-45 Days.

Treatment	N	Subset for alpha = 0.05				
		1	2	3	4	5
A	5	0,1880				
B	5		0,3060			
D	5			0,7140		
E	5				0,5320	
C	5					0,9400
Sig.		0,000	0,000	0,000	0,000	0,000

Based on Table 3 above, it can be explained that the treatment of providing natural water fleas (Daphnia sp) with different doses on the absolute weight growth of guppies from 5-45 days of age for treatment A was significantly different from treatments B, D, E, and C. Furthermore, treatment B was significantly different from treatments D, E, and C. Treatment D was significantly different from treatments E and C, while treatment E was significantly different from treatment C.

The temperature range, average, and standard deviation for each treatment can be seen in Table 4 below.

Table 4. Range, average, and standard deviation of water temperature levels for each treatment and replication.

Treatment	Water Temperature Range (^{O}C)	Average (^{O}C)	Standard Deviation (sd)
A	27,3-27,9	27,5	0,27928
B	27,2-27-8	27,5	0,23022
C	27,2-27-8	27,5	0,22361
D	27-2-27,8	27,54	0,18166
E	27,3-27,9	27,54	0,23022

Based on Table 4 above, it can be seen that the water temperature levels for each treatment showed relatively similar figures. To determine whether there were significant differences between the water temperature levels in each treatment, a one-way ANOVA test was conducted, the results of which can be seen in Table 5 below.

Table 5. One-way ANOVA test for water temperature levels

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	0,012	4	0,003	0,056	0,994
Within Groups	1,068	20	0,053		
Total	1,080	24			

Based on Table 5 above, it can be explained that water temperature did not significantly affect the absolute weight growth of guppies from 5-45 days of age ($P > 0.05$). However, there was a significant effect on the absolute weight growth rate of guppies aged 4-45 days (F < Sign.).

The results of the study showed that dissolved oxygen levels ranged from 5.2 to 5.7 ppm. The range, average, and standard deviation of dissolved oxygen levels for each treatment can be seen in Table 6 below.

Table 6. Range, average, and standard deviation of dissolved oxygen levels for each treatment and replication.

Treatment	Dissolved Oxygen Range (ppm)	Average (ppm)	Standard Deviation (sd)
A	5,2-5,7	5,48	0,19235
B	5,3-5,7	5,5	0,15811
C	5,2-5,7	5,48	0,19235
D	5,3-5,7	5,46	0,16733

E	5,2-5,7	5,46	0,18166

Based on Table 6 above, it can be seen that the dissolved oxygen levels for each treatment were relatively similar. To determine whether there were significant differences between the dissolved oxygen levels in each treatment, a one-way ANOVA test was conducted, the results of which are shown in Table 7 below.

Table 7. One-way ANOVA test for dissolved oxygen levelsini.

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	0,006	4	0,001	0,044	0,096
Within Groups	0,640	20	0,032		
Total	0,646	24			

Based on Table 7 above, it can be explained that dissolved oxygen levels did not significantly affect the absolute weight growth rate of guppies aged 4-45 days (F < Sign.).

The research results showed that the acidity level ranged from 7.3 to 7.8. The range, average, and standard deviation of the acidity levels for each treatment can be seen in Table 8 below.

Table 8. Range, Average, and Standard Deviation of Acidity Levels for Each Treatment and Replication.

Treatment	Acidity range	Average acidity level	Standard deviation (sd)
A	7,4-7,8	7,6	0,19235
B	7,4-7,8	7,62	0,15811
C	7,4-7,8	7,62	0,19235
D	7,3-7,8	7,6	0,16733
E	7,4-7,8	7,6	0,18166

Based on Table 8 above, it can be seen that the acidity levels for each treatment were relatively similar. To determine whether there were significant differences between the acidity levels in each treatment, a one-way ANOVA test was conducted, the results of which can be seen in Table 9 below.

Table 9. One-Way ANOVA Test for Acidity Levels

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	0,006	4	0,001	0,044	0,996
Within Groups	0,640	20	00,032		
Total	0,646	24			

Based on Table 4.9 above, it can be explained that the acidity level does not have a significant effect on the absolute weight growth rate of guppies aged 4-45 days (F < Sign).

DISCUSSION

Feeding water fleas (Daphnia sp.) with different doses significantly affected the absolute weight growth of 5–45-day-old guppy (Poecilia reticulata) fry in experimental tanks. The results showed that treatments A, B, C, D, and E each produced growth rates of 0.19; 0.31; 0.94; 0.71; and 0.53 g/fish, respectively. ANOVA at the 5% level showed that different feed doses significantly affected growth, while further testing at the 5% LSD showed that treatment C yielded the highest results compared to the other treatments.

The high growth rate in treatment C was due to the appropriate feed dosage for the guppy fry's needs, allowing optimal utilization of nutrients through metabolism and conversion into energy for growth. According to Mudjiman (2008), fry can grow well if the feed provided contains sufficient nutrients. Furthermore, matching stomach capacity to feed dosage can improve digestive enzyme performance and fish digestibility (Melianawati and Suwirya, 2010), as well as maintain water quality because feed can be optimally consumed, thus preventing pollution (Muliani et al., 2015).

In treatments D and E, growth tended to decline compared to treatment C due to overfeeding. This condition results in excess protein, resulting in more energy being used for nitrogen excretion than for growth. Uneaten feed residue can also contaminate the media and increase toxic ammonia and nitrite levels. These compounds can damage organs and inhibit the growth of fish fry (Hidayat et al., 2016). Furthermore, overfeeding can reduce digestibility due to limited intestinal microflora ability to secrete digestive enzymes (Mokoginta et al., 2000).

Conversely, treatments A and B showed the lowest growth due to feed dosages that did not meet nutritional needs. Underfeeding leads to energy deficiency, which impacts immune function and increases susceptibility to disease. Boer and Adelina (2006) stated that food is the primary factor influencing growth, and a lack of food can lead to stunted growth. Furthermore, Lentera (2002) emphasized that nutritional deficiencies can lead to slow growth because the body's energy reserves are used for basic activities, not growth.

During the study, the water quality of the rearing medium remained within the normal range, supporting the growth of guppies. The water temperature ranged from 27.2–27.9°C, which is within the optimal range of 24–30°C (Fardiaz, 1992) and 25–33°C (Mulyasi et al., 2012). Dissolved oxygen content ranged from 5.2–5.7 ppm, well above the recommended minimum limit of >4 ppm (Maulana, 2019) and not less than 3 ppm (Sukmara, 2007). The pH value ranges from 7.3–7.8, still within the ideal range of 6.8–8.0 (Kordi and Tanjung, 2002) and 7.2–7.9 (Soelistyowati et al., 2007), so that environmental conditions continue to support optimal growth of guppy fish seeds.

CONCLUSION

The provision of natural water flea (Daphnia sp) feed at different doses significantly affected the absolute weight growth of 5–45 day old guppy (Poecilia reticulata) fry in the experimental tank, with treatment C producing the highest growth of 0.94 g/fish. Water quality parameters during the study, namely temperature 27.2–27.9°C, pH 7.3–7.8, and dissolved oxygen 5.2–5.7 ppm, were within the normal range and had no significant effect on growth. Based on these results, it is recommended that further research be conducted on the provision of natural water flea (Daphnia sp) feed at different doses in contest-sized guppy and other types of freshwater ornamental fish to expand the application of the research results.

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